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A Comparative Study To Evaluate The Efficacy Of Esmolol And Dexmedetomidine In Attenuating Cardiovascular Response To Endotracheal Intubation And Associated Side Effects

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ABSTRACT

Background: Laryngoscopy and tracheal intubation are two of the most uncomfortable medical procedures that are connected to acute hemodynamic reactions that endure for at least ten minutes. When administering general anesthesia to a patient, particular care must be taken to keep the airway open.

Aim and Objective: The aim of the study was to evaluate the efficacy of Esmolol and Dexmedetomidine in attenuating cardiovascular response to endotracheal intubation and its associated side effects.

Methodology: The present Double Blinded Randomized Clinical Trial was conducted in the Department of Anesthesiology, Santosh Medical College and Hospital. Patients undergoing elective surgery under general anesthesia served as the subjects. Between the ages of 18 and 60, a sample of 60 patients with ASA grades I and II were divided into two groups of 30 individuals each.

Result: Result showed that gender distribution was comparable in two groups with insignificant p value 0.26. Patients randomly divided into group D with mean age 31±11.82 years and group E with mean age 35.9±11.82 years which had no statistical significance. Maximum rise in HR, SBP, DBP was observed immediately after intubation which was way higher in Group E i.e. 90.07±3.62, 165.27±3.65, 93.4±4.46 respectively compared to Group D which was 84.8±2.3,128.33±4.96, 83.83±2.87 respectively which was significant with p≤ 0.5 . Comparison of MAP in the two groups revealed that MAP values were comparable at baseline and 15 minute interval (p≥.05).

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Conclusion: Dexmedetomidine (0.5µg/kg) was more effective than esmolol (0.5mg/kg) in attenuation of heart rate response to direct laryngoscopy and tracheal intubation. It concludes that Dexmedetomidine is better in reduction of post- operative nausea and vomiting.

Keywords: Dexmedetomidine, Esmolol, Laryngoscopy, Tracheal intubation.

INTRODUCTION

Anaesthetizing a patient by giving general anesthesia requires special attention with regards to maintaining the airway. Intubating the patient using an endotracheal tube is one of the most favored methods of providing general anaesthesia. However, intubating the patient with an endotracheal tube is not devoid of ill effects [1].

Laryngoscopy and tracheal intubation are among the most painful processes carried out on the human body which are associated with acute hemodynamic responses, lasting for at least ten minutes. These acute changes in hemodynamic status are particularly significant in patients with preexisting predisposing situations like hypertension, myocardial infarction, myocardial malfunction, and cardiovascular diseases [2].

Numerous drugs like opioids, calcium channel blockers, beta blockers [3], magnesium sulphate, local anaesthetics etc have been used to blunt the hemodynamic response to laryngoscopy and intubation. These drugs have variable effects, however, they are associated with some unfavourable complications such as nausea, vomiting, consumedly sedation, and respiratory depression. Therefore, there has been a growing trend to find an effective substitute to reduce these side effects as much as possible [4].

Esmolol is an ultrashort acting beta-1 receptor antagonist that has been used to blunt sympathetic response to perioperative stimuli. Esmolol has no known anesthetic or analgesic properties; however, recent studies have suggested that it may play a role in modulation of the pain response5.

Intravenous Dexmedetomidine, a central alpha [2] agonist is being used in anaesthetic practice as a premedicant. The advantages of Dexmedetomidine as premedicant in anaesthesia setting include sedation, analgesia, anxiolysis & improved hemodynamic stability. Dexmedetomidine is currently being used in the ICU for mechanically ventilated patients for sedation analgesia and rapid recovery after discontinuation [5,6].

Esmolol and Dexmedetomidine both have sympatholytic properties. Therefore the present study is aimed to evaluate the efficacy of Esmolol and Dexmedetomidine in attenuating cardiovascular response to endotracheal intubation and its associated side effects.

MATERIALS AND METHODS

The present Double Blinded Randomized Clinical Trial was conducted in the Department of Anesthesiology, Santosh Medical College and Hospital, after approval of the Institutional Research Committee between May 2016 to May 2017. Subjects were recruited from patients undergoing elective surgery, under general anaesthesia. A sample of 60 patients of ASA grade I and II and aged

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between 18 and 60 was selected were randomly allocated in two groups of 30 each. Group D received Dexmedetomidine 0.5 mcg/kg body weight in 10ml normal saline over 10 minutes before induction While Group E received Esmolol0.5 mg/kg body weight in 10ml normal saline over 10 minutes before induction. Patients with anticipated difficult intubation or the ones in whom more than 1 attempt of intubation is required & took more than 30 seconds excluded from the study.

A thorough pre-anaesthetic evaluation such as Modified Mallampatti Classification grading, mouth opening, neck mobility, thyromental distance and oral cavity assessment was done for all the patients. Physical examination of back to rule out any spinal deformity was done. Routine hematological, biochemical investigations such as Complete Blood Count, Renal Function Test, Coagulation profile, chest X-ray, Electrocardiogram (ECG), urine routine examination and random blood sugar was be done.

Vital parameters such as Heart Rate (HR), Systolic Arterial Pressure(SAP), Diastolic Arterial Pressure(DAP) and Mean Arterial Pressure(MAP) were recorded, at baseline, during intubation and after 1, 3, 5, 10, 15 and 20 mins after intubation using multipara monitor. Any side effects like nausea and vomiting during the administration of anaesthetic agent and duration of surgery was also noted.

RESULTS

A comparative study between Dexmedetomidine and Esmolol was done for assessing the haemodynamic changes on intubation in 60 patients undergoing elective surgeries at Santosh Medical College, Ghaziabad during the period of May 2016 to May 2017 under general anaesthesia.

Table1: Demographic data distribution of study subject.

Demp ographic Distribution		Number (Percentage)
Gender	Male	18 (30%)
	Female	42 (70%)
Age Groups	11-20	9 (15%)
	21-30	21 (35%)
	31-40	16 (26.67%)
	41-50	9 (15%)
	51-60	5 (8.33%)
Age (Mean±SD)	Group D	31±11.82
	Group E	35.9±11.82

Table 1 shows the demographic characteristic of subjects. Out of 60 patients, 18 (30%) were male and 70% were female. Majority, 35%, of the patients were from the age-group 21-30 followed by

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26.67% from age-group 31-40. Patients randomly divided into group D with mean age 31±11.82 years and group E with mean age 35.9±11.82 years. P value was insignificant with gender and age.

Table2: Comparison of Mean Heart Rate, Mean Systolic Blood Pressure, Mean Diastolic Blood Pressure and Mean Arterial Pressure of patients between Groups.

Comparison Parameters	Incidence	GroupD (Mean±SD)	GroupE (Mean±SD)	Pvalue
Mean Heart Rate of Dexmedetomidine and Esmolol	Baseline	81.4±2.18	80.07±3.62	0.089
	Induction	79.4±2.18	77.73±3.67	0.036
	Intubation	84.8±2.3	90.07±3.62	0.000
	1 Min	81.37±2.55	88.07±3.62	0.000
	5 Min	77.2±1.93	84.17±3.46	0.000
	15Min	78.8±1.78	81.07±3.78	0.004
	20Min	80.53±1.74	80.2±3.87	0.669
Mean Systolic Blood Pressure	Baseline	120±4.89	120.53±3.64	0.634
	Induction	106±4.89	116.13±3.75	0.000
	Intubation	128.33±4.96	165.27±3.65	0.000
	1 Min	125.9±5.04	155.53±3.95	0.000
	5 Min	119.53±4.89	135.73±3.95	0.000
	15 Min	118.13±4.75	122.8±3.91	0.000
	20 Min	118.6±5.17	120.6±3.93	0.097
Mean Diastolic Blood Pressure	Baseline	78.33±2.974	79.4±4.46	0.280
	Induction	72.33±2.97	75±4.66	0.011
	Intubation	83.83±2.87	93.4±4.46	0.000
	1 Min	81.80±2.94	89.4±4.46	0.000
	5 Min	71.80±2.94	78.2±4.82	0.000
	15 Min	74.33±2.97	74.2±4.82	0.898
	20 Min	77.13±3.01	72.2±4.82	0.000
Mean Arterial Pressure	Baseline	92.2±2.95	93.1±3.22	0.264
	Induction	91.17±2.85	101±3.23	0.000
	Intubation	98.63±2.88	117.37±3.23	0.000
	1 Min	96.5±2.92	111.5±3.4	0.000
	5 Min	87.73±2.92	97.47±3.51	0.000
	15 Min	89.07±2.81	90.37±3.52	0.120
	20 Min	91±2.88	88.33±3.48	0.002

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From Table 2, It was observed that Maximum rise in heart rate was observed immediately after intubation which was way higher in Group E compared to Group D. This rise was gradually attenuated across 20 minutes.

The mean and standard deviation of the systolic blood pressure (SBP) measurement of Group E at different intervals of surgery. It was observed that there was a fall in SBP at induction by -3.65% this was followed by sudden increase in SBP by 37.11% from baseline SBP (120.53±3.64) to 165.27±3.65 immediately after intubation. Whereas in Group D fall in SBP at induction by 14% followed by increase in SBP by 8.40% from baseline after intubation. Comparison of SBP in the two groups revealed that the systolic blood pressures were comparable at baseline and after 20min ($p \geq .05$).

Maximum rise in DBP was observed immediately after intubation, which was way higher in Group E (93.4±4.46 from 79.4±4.46) compared to Group D(83.83±2.87 from 78.33±2.974). This rise was gradually attenuated across 20 minutes to near baseline values. However, there was statistically difference in diastolic blood pressures at induction, intubation, 1, 3,5,10 and 20 minutes interval with $p \leq 0.05$.

Maximum rise in MAP was observed immediately after intubation, which was way higher in Group E (117.37±3.23 from 93.1±3.22)compared to Group D(98.63± 2.88 from 92.2± 2.95). Comparison of MAP in the two groups revealed that MAP values were comparable at baseline and 15 minute interval ($p \geq .05$). However, there was statistically difference in diastolic blood pressures at induction, intubation, 1, 3,5,10 and 20 minutes interval with $p \leq 0.05$.

Table 3: Post-Operative Incidence of Nausea and Vomiting Comparison between Two Groups in %

Incidence	Number (%)		pvalue
	Group D	Group E	
Nausea	4 (13.33)	6 (20)	0.24
Vomiting	1 (1.33)	2 (6.67)	0.27
Hypertension	0 (0)	30 (100)	0.0013
Hypotension	0 (0)	0 (0)	-
Tachycardia	0 (0)	0 (0)	-
Bradycardia	0 (0)	0 (0)	-

Table 3, depicts that there was no incidence of tachycardia, bradycardia and hypotension in either Groups. However, hypertension was observed in all 30 patients premedicated with esmolol indicating statistically highly significant difference ($p<0.001$). Postoperative nausea incidence were higher in Esmolol group (Group E) i.e. 20% whereas it was 13.33% in group D, but is statistically insignificant ($p \geq 0.05$). And postoperative vomiting incidence were also higher in Esmolol group (Group E) i.e. 6.67%, whereas it was 3.33% in group D. But it is statistically insignificant ($p \geq 0.05$).

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DISCUSSION

The present study evaluates the intravenous premedication with Dexmedetomidine and Esmolol for hemodynamic stability during laryngoscopy and endotracheal intubation. Hemodynamic changes occurs in response to laryngoscopy and intubation, probably due to intense sympathetic discharges caused by stimulation of epipharynx and laryngopharynx. [7] Numerous techniques have been used to reduce the incidence and severity of these hemodynamic responses. [8]

Esmolol is water soluble, rapid onset, ultra-short-acting, selective beta adrenergic receptor antagonist with proven efficacy to provide hemodynamic stability during laryngoscopy and tracheal intubation. [2] It has a half-life of nine minutes and without severe side effects. It has been administered in various doses ranging from 0.5-2 mg/kg. Shrivastava et al in their study concluded that 1-1.5mg/kg is most effective in attenuating haemodynamic responses during laryngoscopy and intubation without major adverse effects. [9]

In the present study compared the attenuating effect of Dexmedetomidine and Esmolol pre and post intubation. The rise in heart rate was gradually settled over the next 15 minutes followed by an increase to 80.53±1.74 at 20 mins interval in group D. In group E the baseline heart rate was 80.07±3.62. Following study drug infusion a decreasing trend was noted accounting upto 2.92% fall in HR at induction.

The heart rates between the groups was highly significant (p value <0.05) at the following time intervals, i.e. Induction, intubation, 3, 5, 10 and 15 min interval showing superior effect of dexmedetomidine in prevention of tachycardia following direct laryngoscopy and intubation. Similar observations were noted by Gogus N et al, in a study to compare the effects of dexmedetomidine (1µg/kg), fentanyl (2µg/kg) and esmolol (2mg/kg) on prevention of hemodynamic response to intubation. [10]

The heart rate response to dexmedetomidine was also similar to the study conducted by Bajwa SS. et al [13] who noticed that 1mg/kg dexmedetomidine adequately attenuated the tachycardia in response to laryngoscopy and endotracheal intubation. Upon overall comparison between the two groups, the heart rate was better controlled with Dexmedetomidine than Esmolol after laryngoscopy and intubation over period of 20 minutes. Similar result was seen in the Reddy SV [12] and Srivastava VK [13] et al.

The mean baseline systolic blood pressures were comparable in both the groups (p value 0.634). The SBP was reduced following drug infusion in both the groups. The current study showed that dexmedetomidine is more potent in attenuating the sympathetic response to intubation. The current study is in concurrence with the study conducted by Reddy et. al. They also found an increase in systolic blood pressure immediately following intubation. Similar results were found in the study conducted by Selvraj V.

The baseline DBP was 78.33±2.97 in group D while in group E, the baseline DBP was 79.4±4.46. The baseline diastolic blood pressures were comparable in both the groups (p value 0.28). Both the

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groups showed a reduction in diastolic BP following study drug infusion (Induction). This was in accordance with the findings of Reddy S.V. et al.

In our study the baseline MAP was 99.2 ± 2.95 in group D. In group E, the baseline MAP was 93.1±3.22. When MAP is considered, baseline values were comparable in both the groups (p value 0.264). Like other studies conducted by Reddy SV [12] Vinit K. S.[14] and Selvaraj V [15] the current study also shows attenuation of MAP values post intubation nearing baseline values

In the current study no instance hypotension or bradycardia was noted in either Group D or Group E. The values in Group D didn't show any hypertension indicating Dexmedetomidine indicating statistically significant difference in the two group D ($p< 0.001$). The current study also concurs with the findings of Selvaraj V et al [14] and Srivastava et al [16] who also considered Dexmedetomidine to be a superior pre-anaesthetic drug compared to Esmolol in attenuation of haemodynamic responses.

Postoperative nausea incidence were higher in Group E 20% whereas it was 13.33% in Group D which is insignificant($p>0.05$).

The lacunae of the current study was that the intrinsic response to stress of laryngoscopy and intubation have significant interring individual variability and would have affected the values recorded. This could be a possible drawback of the study. There can also be an inter-individual variation in performing the laryngoscopy to trigger a response and so do its magnitude. However, inspite of shortcomings, still the findings of the current can be generalized to the patients undergoing laryngoscopy and intubation.

CONCLUSION

The present study concluded that Dexmedetomidine 0.5µg/kg administered prior to surgery was associated with relatively lesser rise in systolic, diastolic blood pressure and mean arterial pressure after laryngoscopy and intubation when compared to Esmolol.

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